EBAA IRON Connections™
TECHNICAL DATA FOR THE WATER AND WASTEWATER PROFESSIONAL

GI-4
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OBSERVATIONS OF MEGALUG® MECHANICAL JOINT RESTRAINTS IN CORROSIVE ENVIRONMENTS

INTRODUCTION

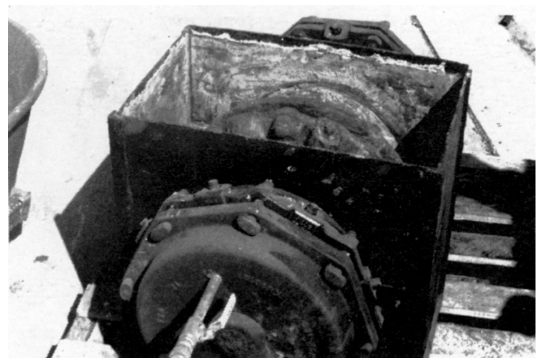
Since its introduction in the early 1980's, the MEGALUG® joint restraint has proven itself in thousands f installations across the country. However, the effect a corrosive environment may have on a MEGALUG restraint is still questioned. In a like manner, what effect does a MEGALUG have on a pipe in a corrosive environment? These questions, for which only time would provide the answer, can now be addressed. This bulletin will look at these questions in light of observations of two tests conducted by EBAA Iron and a sample removed from the field after nearly ten years of service.

IN HOUSE TESTING

In November 1993, EBAA began a three-month test in which a test section was placed in a 3% salt solution. The test section consisted of short sections of mechanical joint and plain end ductile iron pipe restrained with a MEGALUG restraint. Low alloy steel T-bolts were used to make the joint. MEGALUG restraints and caps sealed the pipe ends. The section was filled with water, vented of any air, and pressurized to 150 psi. The test section was placed in a tank with the plain end part of the joint completely submerged. All but two pockets of the restraint and one and one half of the T-bolts were submerged. The ends of the test section extended through the tank walls and were not exposed to the salt water.

At the end of the three month period, the test section was carefully disassembled and photographed. The T-bolts above the water displayed more corrosion build up than the bolts under the water. However, the buildup of corrosion products suggested that the immersed part of the mechanical joint bolt flange suffered greater attack then the part out of the water. The plain end portion of the pipe displayed a uniform amount of corrosion. The buttresses created by the wedges on the pipe exposed to the salt water did not differ from the buttresses on the ends of the pipe that were not exposed. The wedge teeth and the metal directly under the wedges were shiny which would indicate that these areas were free from corrosive attack.

The next test EBAA Iron conducted began in March 1994 and lasted one year. Another ductile iron test section, pressurized to 150 psi, was placed in the corrosion tank and the tank was filled with sand. The sand was saturated with salt water (3% salt). Holes in the bottom of the tank allowed the salt water to drain. This filling and draining process was repeated once every other week.

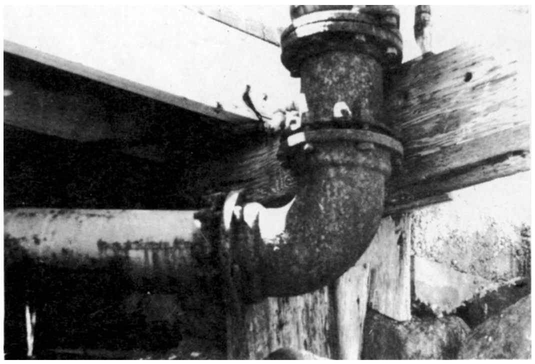


After a year, the test section was uncovered for observation. The gland, the pipe bell, and the bolts on the top half of the pipe had a tightly adherent scaly buildup. The bottom half had less of a buildup than the top. The scale made the parts appear very pitted and corroded. It was determined that the restraint, the pipe, and the T-bolts had graphitized. The iron ions had been leached out into the sand and the graphite structure remained. This was evidenced by the rusty color of the sand near the gland and pipe. The graphite was removed by blasting the mechanical joint. After the joint had been blasted, it was obvious that the top portion of the test section, restraint, pipe, and T-bolts, had been subjected to severe corrosive attack as evidenced by some large pits. The T-bolts that had been at or near the top of the joint had large sections corroded away. The lower half of the gland and pipe bell as well as the T-bolts were less severely attacked. The restraint gland and the pipe bell appeared to have a similar amount of pitting. The plain end pipe had some pitting but not as great as the bell and the gland. The pitting was much less extensive on the lower portion of the test section.

Finally, the joint was disassembled and the gland removed from the pipe. The marks on the pipe made by the wedges were still shiny, indicating little to no corrosive attack. The wedges did have some pitting, primarily towards the back. All the wedges remained in firm contact with the pipe and the test section remained pressurized.

OBSERVATIONS FROM THE FIELD

After nearly ten years of service, an eight inch elbow and two pipe sections (one pipe section had a flange on the other end) restrained to the elbow with MEGALUG restraints was removed and sent to EBAA for study. The fitting was located on a pier near San Luis Obispo, CA that was subject to salt spray from the ocean. This section was part of a fire protection line that had a working pressure of 80-100 psi. The fitting, the pipe sections and the glands were initially coated with coal tar epoxy.



The fitting, pipe sections, and the MEGALUG restraints seemed to have quite a severe buildup of corrosion products. The most severe corrosion appeared to be on the flanged pipe. Removal of the corrosion layer on the elbow and the pipe sections revealed fairly uniform corrosion with some severe pitting. The MEGALUG glands and the bolts were covered with small pits; however, the lettering on the glands was still legible. The T-bolts on the plain end pipe could be loosened with a socket wrench. Two of these bolts broke during disassembly. The T-bolts on the flanged pipe had to be cut off. The glands were cut off both pipe sections to minimize the disturbance of the corrosion products.

There was a relatively large amount of corrosion product on the area of the pipes under the glands. The area under the MEGALUG restraint's gripping wedges showed quite a bit of corrosive build-up although the points of contact were shiny. The sample was then sent to an outside laboratory for analysis.

The laboratory analysis concluded that the sample had undergone corrosive attack due to exposure to a chloride environment. In addition, the laboratory report stated that the build up of corrosion products was most likely uniform but that the products were allowed to flake away from the fitting and part of the pipe surface due to the washing action of the salt water spray. The other corrosion products were held

in place on the pipe surface immediately under the restraint gland. The analysis also indicated that the pipe surface was subject to a uniform corrosion and that the MEGALUG restraint **did not** accelerate the corrosion at the point of contact. "Examination of the cross-section at and away from the contact point disclosed a remaining wall thickness of 0.383 inches…This indicates a uniform corrosive attack of the entire flange pipe surface with no indication of acceleration attack at the flange pipe and mega lug [sic.] gland contact point."

CONCLUSION

Because the MEGALUG restraint is made from ductile iron, it is subject to attack by corrosion in the same manner as ductile iron pipe and fittings. Also, the MEGALUG restraint does not increase the rate of corrosion of ductile iron pipe or ductile iron fittings. In each of the three samples, the MEGALUG restraint did not fail or cause any part of the system to fail.

As mentioned above, the MEGALUG is made of ductile iron just as the pipe and fittings are. By using similar materials, the risk of galvanic corrosion is reduced. However, ductile iron is still susceptible to galvanic corrosion and may need some type of corrosion protection. Connections™ bulletins GI-1, GI-2, and GI-3 provide some tips for reducing corrosion.

REFERENCE

"A Metallurgical Evaluation of a Ductile Cast Iron Flange Pipe and Mega Lug [sic] Gland," Jeffrey L. Milam, and Mahesh J. Madhani, Hurst Metallurgical Research Laboratory, Inc., 1995.

This is one of a series of CONNECTIONS reports addressing design and application subjects. If you would like copies of other reports or a listing of available reports contact your EBAA Iron representative or call EBAA Iron Sales at (800) 433-1716 or fax (254) 629-8931. EBAA's engineering group can be reached at (800) 633-9190 or fax (254) 629-2079.

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